10-1-2018

Achieving Cohesiveness in Healthcare with Music, Motion, Technology, and Accountability: Novel Approaches for Music Therapy in the Digital Health Era

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Abstract

This paper addresses the importance of music in therapy and education, focusing on the population segments of children with special needs and Parkinson's patients. It also highlights the importance of rhythm in motion with the absence of music. It also address ways to measure and compare methods, as well as their impact and how technology can help us with that.

Music and Health Institute Terms

Autism Spectrum Disorder; Music Therapy; Neurologic and Muscular Disorders; Parkinson Disease; Receptive Music Methods

Disciplines

Music Therapy | Neuroscience and Neurobiology

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"Divide each difficulty into as many parts as is feasible and necessary to resolve it. It is not enough to have a good mind; the main thing is to use it well."
Cogito ergo sum. (I think; therefore I am.)
Rene Descartes

Introduction

The demand for music therapists has gradually expanded as healthcare programs seek more non-invasive methods of treatment. The importance of introducing music into different forms of therapies is increasing, as the success of such treatment demonstrates benefits that address emotional, physical and even cognitive needs. Why are therapeutic music techniques important? What could music transfer to the brain that drugs cannot?

This paper addresses the importance of music in therapy and education, focusing on the population segments of children with special needs and Parkinson's patients. It also highlights the importance of rhythm in motion with the absence of music. It also address ways to measure and compare methods, as well as their impact and how technology can help us with that. Some impacts have been observed in the long term, but what if harnessing technology in real time helps us track each step to improve our techniques, maximize the benefits, and more accurately measure results?

How can we be held accountable for our methods, our innovations and varied techniques to improve health conditions for those in need and those who are underserved? A synergistic combination of elements that we will encounter in this paper through four sections includes Music, Motion, Technology, and Accountability.

Music

"*There is no truer truth obtainable by man than that which comes of music."*
Robert Browning

Music has always been a powerful tool. Music expresses emotions that we are unable to put into words, it releases anger and tension, and it can be used as a way to motivate individuals and to harmoniously sync the body and the mind. We use music during exercise and other tasks to relieve boredom, but also to enliven a motivated activity by following a synchronized rhythm that enhances our stamina. Music is a part of almost every facet of human life, but before expanding on its varied benefits, there will be a focus on its therapeutic aspects.

Music therapy is increasingly used to treat everything from Autism to Parkinson's and aims to foster positive growth and clinical improvement in individuals using music as a vehicle for

achieving patient-centered goals. The earliest known reference to music therapy appeared circa 1789 in *Columbian Magazine,* titled "Music Physically Considered" (1). There were however, no recorded music therapy interventions or systematic experiments using music therapy until later in the 1800s (2). There are numerous mentions of music as a healing medium as far back in history as the Biblical scriptures and historical writings from such diverse ancient civilizations as those in Asia, India, China, Egypt, Greece and Rome, demonstrating how long music has had a lasting impact on society.

Around the world, there is a growing demand for music therapists, and music is becoming integrated into patient care in hospitals, clinics and at home. These therapeutic applications underscore music's role as a language of the heart and soul and as an important tool to stimulate the brain's function. Music is being used as an aid to brain-damaged patients and has shown positive results in preventing depression. NIH Director, Dr. Francis Collins, notes that: "The brain is able to compensate for other deficits sometimes by using music to communicate." He continues that, for those practices to have the greatest scientific and medical significance, "it would be a really good thing to know which parts of the brain are still intact to be called into action. To know the circuits well enough to know the backup plan."

It is crucial to note that music has the potential to act on the brain's plasticity, emotion, physical health and linguistic processing, particularly in persons who have a traumatic brain injury (TBI) or Autism-Spectrum Disorder (3). According to Carolyn Ticker (3) music may cause physiological changes in heart rate, respiration, skin temperature, skin conductance and hormone secretion; this leads to the conclusion that music can be used to affect both mental and physical conditions. Similarly, the consistent use of music in education helps students to recall information, strengthen memory consolidation, increase attention and improve reasoning. Specific music approaches can vary depending on an individual's age, medical history or type of injuries. Music approaches may employ rhythmic auditory stimulation (RAS) which connects rhythm and movement, singing, improvising, and/or composing. The type of music engagement used depends on patient preferences, status and goals.

Experts across various medical specialties and industries are beginning to hone techniques for using music as an important part of treatment. However, a current obstacle is a lack of quantitative data that measures the impact of music or music variable on the intended outcome. By being able to effectively analyze the impact of specific music in various populations and settings, music therapists will be able to increase their understanding of how to best deliver music as a tool for healing and individual development.

Motion

"*Rhythm and harmony find their way into the inward places of the soul."*
Plato

Music moves us: we have all heard or said this ourselves. People may encounter someone who appears to "have rhythm" and others who seem to have no rhythm. Some might argue that specific movements attributed to a specific yet universal music genre demand a specific rhythm, which could lead us to reject the hypothesis of the subjectivity of rhythm. To clarify this, a

person is either a good Salsa dancer or not; that in itself is a perception drawn by cognitive processes.

Despite its significance in universal expressions of emotions, the music-movement relationship is poorly understood. The PNAS (Proceedings of the National Academy of Sciences of the United States of America) has conducted research where they "presented an empirical method for testing whether music and movement share a common structure that affords equivalent and universal emotional expressions." A research team undertook two experiments, one in the United States, and the other in an isolated tribal village in Cambodia. These experiments revealed findings that led to the conclusion that music and movement can express the same emotion; the common structure between music and movement is evident within and across cultures (4). As stated earlier in this paper, music is not the only medium to express emotion, as human behavior also reveals unspoken words in movement. We perceive the power of singing in a choir and musical ensembles to be the equivalent, in the absence of sound, to the rhythm and harmony of a military march.

According to Charles Darwin, in his book *The Expression of the Emotions in Man and Animals*, facial expressions and other emotional movements are universal across cultures. This lends credence to the notion that both music ***and*** motion express emotion. In his PhD thesis, Haga discusses the role of rhythm in the relationship between music and movement and questioned the meaning of their similarities, specifically: which features in music and movement are we referring to, and what is heard in music that is similar to what we see in a movement? In analyzing them separately, Haga provided thoughtful insights on the relationships between music and body movement (5). Based on this and other research, both music and movement may be valuable tools in therapy.

When using therapies that are based on rhythmic motion and melody, we engage with cognitive issues. People with Parkinson's disease suffer from bradykinesia, or a slowness of movement that can lead to difficulties with simple daily activities in their lives. Progressing movement through rhythmic exercise increases patients' focus and attention to coordinate motion and remember it later (6).

Technology

"Everything is designed. Few things are designed well."
Brian Reed

This section ties together the previous sections on music, motion and technology. In October 2018, the Berklee College of Music hosted an event entitled "Music and Health Exchange: Crossroads of Music and Technology"(7), where I had the pleasure of giving a presentation along with Point Motion's CEO and founder Kevin Clark.

To store data accurately and to capture the status of a patient over time, health centers use what is called EHR/EMR or Electronic Health Record and Electronic Medical Record. The EMR began as a method to trace and document any patient's medical records and conditions combined with third-party accessibility. The first EMR system was developed in 1972, but was not

considered greatly sophisticated, and was used mostly at government hospitals. EMR and EHR are different. EMR gives a snapshot of the medical records of a patient, whereas EHR provides a snapshot of their overall health condition. In comparison, they are very similar and complementary, as the idea came from the same concept and the general need to track data in real time and access it from a single point. Using the example of an autistic child who has been receiving music therapy while also changing medications or even dosages throughout the treatment, the EHR allows his therapist to trace the change in behavior back to what could have potentially caused it. EPIC-Health, for example, is an EHR with document management systems that health institutions commonly use.

Similarly, in education, schools use an LMS, or Learning Management System, where they can track, record and document the delivery of course materials. Derived from the same technology as the EHR, we find the UnitusTI , known as an EDR (Electronic Data Records) Platform, a program/curricula/material management system with publishing, specialized data acquisition structures and psychometrics. UnitusTI caters to the treatment, education and training fields, hence the use of the word "data" is neutral.

What benefit is technology if it does not help humans' work become more efficient? The advantage of digital technology lies in the power of data to provide deeper insights, along with the ability to undertake a more comprehensive tracking of trends and patterns that can in turn be used to build an effective personalized treatment approach.

One of the drawbacks of Electronic Records is that even though it remedies the loss of data and allows health/education staff to make an informed decision of what their patient/student needs, it still requires manual data entry. Point Motion Inc., an innovative digital health / therapeutics company led by C-Level executives who graduated from Berklee College of Music, was able to connect the dots using their musical expertise and through partnering with subject matter experts (SMEs) and EDR platforms. Point Motion's patented technology works through a camera and series of body movements to capture and activate musical filters, sounds and effects. Their aim is to use a musically enriching experience as a therapy for children with special needs and individuals with Parkinson's disease. These individuals can play a computer-based game through body movement, while data is collected from their interactions and sent to an EDR platform to help their therapist make informed decisions. This combination of music, motion, and technology enables the patient to experience music in their therapy sessions, encourages patient expression through motion and allows their therapist to access real time data and information via a cloud-based platform (8). In this way, music therapists are able to track their patient's progress using metrics, such as focus, range of motion, mobility, expression and more.

Researchers have talked about the new opportunities provided by the development of technology to introduce novel approaches for the interaction of music and sound to individuals with autism (9). Through engaging on a cognitive and multi-sensory level via technology-based therapy that is free from social constraints and complex core communication, this method provides a consistent and objective outcome. As a result, we observe sustained interest and increased mastery while maintaining high engagement and motivation. The purpose of this is not to eliminate the role of the therapist or undermine the importance of human interaction that brings empathy and care in different ways; rather, it is to facilitate using therapies and optimizing

outcomes for the benefit of the patient/student. The technology permits the establishment of a non-threatening and unbiased environment in which individuals can develop new skills and overcome potential fears and discomfort.

Accountability

"Strive not to be a success, but rather to be of value."
Albert Einstein

It is important to mention here the issue of accountability when using objective and consistent data, ensuring that specialists can make informed decisions when accessing patient records. How can we introduce a new medication to a patient if we can't track their immediate and long-term reaction to the treatment? Treating patients with severe brain injuries, Alzheimer's, Parkinson's, and even children with special needs should not be reactive, but proactive. One would not prescribe an insulin dose to a diabetic child without having a way to measure their blood sugar and other health factors. Yet, children with special needs are taking medications that affect their cognitive development without a readily available tool to measure the impact of those medications over time.

In the United States, the Food and Drug Administration (FDA) examines, tests and approves items subject to medical use, such as drugs and medical appliances. To get FDA approval, drug manufacturers and pharmaceutical companies conduct clinical trials and testing and submit their data to the FDA. Once the data is reviewed, the FDA can approve the drug "if the agency determines that the benefits of the drug outweigh the risks for the intended use" as defined by law. The FDA intends to permit the widest possible use of electronic technology that respects their responsibility to protect public health.

There are several parties affected by FDA regulations. For example, a newly signed law, the "Special Registration for Telemedicine Act of 2018," allows physicians and other providers to prescribe controlled substances via telemedicine without requiring an in-person exam. This new law is a huge step forward in the telehealth and digital health industry. The primary factor affecting reimbursement for clinical services rendered is legal policy, but when approved for reimbursement, innovations within the sector will continue to flourish, as even healthcare is driven by profitability.

Innovative care models and regulations should work hand in hand, not burdening each other, but helping to document progress while remaining accountable. Bringing Point Motion Inc. as an example again, this tool helps hospitals measure impact with quantified data which, in turn, not only helps reach an informed decision and increases the accountability for specific treatments, but also it makes it easier to apply for research grants, when the impact can be measured and documented.

Technology is an essential component to establishing accountability within a context of finite resources, i.e., time and money. As the population grows, tools will be needed to automate the current processes for assessment that require in-person observation, which are at times subjective and prone to error. Without technology to ensure accountability for the gain/loss in various

treatments, there will not be a sufficient workforce to personally supervise clients. This could lead to errors in diagnosis and prescription dosing, and result in underserved populations with fewer financial resources.

Conclusion

It is highly important—through personal shared experiences, data and research, and observed impact—to underscore the value of music and its benefits in healthcare and education. Research is underway to further observe and quantify its impact on the mind, severe brain injuries, Parkinson's Disorder (PD) and Autism Spectrum Disorder (ASD) for instance, as well as its physiological benefits, from reducing stress and anxiety to regulating blood pressure and even skin temperature. It is also crucial to acknowledge the importance of rhythm in motion, with or without music, as a cognitive process.

Technology helps us track our therapeutic methods through EDR platforms and measure the impact of care plans, creating increased accountability on differentiated drug dosing and more awareness of a patient's progress over time. Different segments and age groups, depending on their individual case, may react differently to music technology on a cognitive and social level. However, technology-based music therapy remains a powerful approach in reducing patient discomfort and individual bias. It also engages in motivational musical approaches that foster creativity and build focus and skill mastery.

As a community of music lovers, healthcare professionals, educators, and technology enthusiasts, we should recognize the importance of having a tool that provides the four elements mentioned in this paper: music, motion, technology and accountability to improve outcomes for health and education holistically and non-invasively. A way of bridging and enhancing these crucial elements is now feasible, reliable and available.

To learn more about Point Motion, Inc, an innovative digital health company that is harnessing the synergistic power of Music, Motion, Technology, and Accountability, visit www.pointmotioncontrol.com, or reach out to us at info@pointmotioncontrol.com to book a Demo.

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